

WHAT IS CLAIMED IS:

1. A protein shown in (A) or (B) below:

(A) a protein having an amino acid sequence of SEQ. ID No. 1 in the Sequence Listing;

(B) a protein having an amino acid sequence of SEQ. ID No. 1 in the Sequence Listing, wherein the amino acid sequence includes substitution, deletion, insertion, addition or inversion of one or several amino acids and wherein the protein has an erythrose reductase activity.

2. A DNA encoding a protein shown in (A) or (B) below:

(A) a protein having an amino acid sequence of SEQ. ID No. 1 in the Sequence Listing;

(B) a protein having an amino acid sequence of SEQ. ID No. 1 in the Sequence Listing, wherein the amino acid sequence includes substitution, deletion, insertion, addition or inversion of one or several amino acids and wherein the protein has an erythrose reductase activity.

3. The DNA as claimed in claim 2, wherein the DNA comprises one shown in (a) or (b) below:

(a) a DNA containing a base sequence comprising at least

nucleotides Nos. 1 to 399 out of the nucleotide sequence described in SEQ. ID No. 1 in the Sequence Listing.

(b) a DNA hybridizing with a base sequence comprising at least nucleotides Nos. 1 to 399 out of the nucleotide sequence described in SEQ. ID No. 1 in the Sequence Listing or a probe prepared therefrom under a stringent condition and encoding a protein having an erythrose reductase activity.

4. The DNA as claimed in claim 3, wherein the stringent condition is a condition under which washing is performed at a salt concentration corresponding to 2×SSC containing 0.1% SDS at 60°C.

5. The DNA as claimed in claim 2, wherein the DNA comprises a DNA shown in (c) or (d) below:

(c) a DNA containing a base sequence comprising at least nucleotides Nos. 408 to 1119 out of the nucleotide sequence described in SEQ. ID No. 1 in the Sequence Listing.

(d) a DNA hybridizing with a base sequence comprising at least nucleotides Nos. 408 to 1119 out of the nucleotide sequence described in SEQ. ID No. 1 in the Sequence Listing or a probe prepared therefrom under a stringent condition and encoding a protein having an erythrose reductase activity.

6. The DNA as claimed in claim 5, wherein the stringent condition

is a condition under which washing is performed at a salt concentration corresponding to 2×SSC containing 0.1% SDS at 60°C.

7. A cell to which a DNA has been transferred as claimed in any one of claims 2 to 6 in a manner such that the DNA is capable of expressing an erythrose reductase type III the DNA encodes.

8. A method for producing erythrose reductase type III, comprising the steps of cultivating a cell as claimed in claim 7 in a medium to produce and accumulate erythrose reductase type III in a culture liquid and harvesting the erythrose reductase type III from the culture liquid.

9. A protein shown in (C) or (D) below:

(C) a protein having an amino acid sequence of SEQ. ID No. 2 in the Sequence Listing;

(D) a protein having an amino acid sequence of SEQ. ID No. 2 in the Sequence Listing, wherein the amino acid sequence includes substitution, deletion, insertion, addition or inversion of one or several amino acids and wherein the protein has an erythrose reductase activity.

10. A DNA encoding a protein shown in (C) or (D) below:

(C) a protein having an amino acid sequence of SEQ. ID No. 2 in

the Sequence Listing;

(D) a protein having an amino acid sequence of SEQ. ID No. 2 in the Sequence Listing, wherein the amino acid sequence includes substitution, deletion, insertion, addition or inversion of one or several amino acids and wherein the protein has an erythroose reductase activity.

11. The DNA as claimed in claim 10, wherein the DNA comprises one shown in (e) or (f) below:

(e) a DNA containing a base sequence comprising at least nucleotides Nos. 1 to 399 out of the nucleotide sequence described in SEQ. ID No. 2 in the Sequence Listing.

(f) a DNA hybridizing with a base sequence comprising at least nucleotides Nos. 1 to 399 out of the nucleotide sequence described in SEQ. ID No. 2 in the Sequence Listing or a probe prepared therefrom under a stringent condition and encoding a protein having an erythroose reductase activity.

12. The DNA as claimed in claim 11, wherein the stringent condition is a condition under which washing is performed at a salt concentration corresponding to 2×SSC containing 0.1% SDS at 60°C.

13. The DNA as claimed in claim 10, wherein the DNA comprises a DNA shown in (g) or (h) below:

(g) a DNA containing a base sequence comprising at least nucleotides Nos. 408 to 1077 out of the nucleotide sequence described in SEQ. ID No. 2 in the Sequence Listing.

(h) a DNA hybridizing with a base sequence comprising at least nucleotides Nos. 408 to 1077 out of the nucleotide sequence described in SEQ. ID No. 2 in the Sequence Listing or a probe prepared therefrom under a stringent condition and encoding a protein having an erythrose reductase activity.

14. The DNA as claimed in claim 13, wherein the stringent condition is a condition under which washing is performed at a salt concentration corresponding to 2×SSC containing 0.1% SDS at 60°C.

15. A cell to which a DNA has been transferred as claimed in any one of claims 10 to 14 in a manner such that the DNA is capable of expressing an erythrose reductase type II the DNA encodes.

16. A method for producing erythrose reductase type II, comprising the steps of cultivating a cell as claimed in claim 15 in a medium to produce and accumulate erythrose reductase type II in a culture liquid and harvesting the erythrose reductase type II from the culture liquid.

17. A protein shown in (E) or (F) below:

(E) a protein having an amino acid sequence of SEQ. ID No. 3 in the Sequence Listing;

(F) a protein having an amino acid sequence of SEQ. ID No. 3 in the Sequence Listing, wherein the amino acid sequence includes substitution, deletion, insertion, addition or inversion of one or several amino acids and wherein the protein has an erythroose reductase activity.

18. A DNA encoding a protein shown in (E) or (F) below:

(E) a protein having an amino acid sequence of SEQ. ID No. 3 in the Sequence Listing;

(F) a protein having an amino acid sequence of SEQ. ID No. 3 in the Sequence Listing, wherein the amino acid sequence includes substitution, deletion, insertion, addition or inversion of one or several amino acids and wherein the protein has an erythroose reductase activity.

19. The DNA as claimed in claim 18, wherein the DNA comprises one shown in (i) or (j) below:

(i) a DNA containing a base sequence comprising at least nucleotides Nos. 1 to 399 out of the nucleotide sequence described in SEQ. ID No. 3 in the Sequence Listing.

(j) a DNA hybridizing with a base sequence comprising at least nucleotides Nos. 1 to 399 out of the nucleotide sequence described

in SEQ. ID No. 3 in the Sequence Listing or a probe prepared therefrom under a stringent condition and encoding a protein having an erythrose reductase activity.

20. The DNA as claimed in claim 19, wherein the stringent condition is a condition under which washing is performed at a salt concentration corresponding to 2×SSC containing 0.1% SDS at 60°C.

21. The DNA as claimed in claim 18, wherein the DNA comprises a DNA shown in (k) or (l) below:

(k) a DNA containing a base sequence comprising at least nucleotides Nos. 408 to 1121 out of the nucleotide sequence described in SEQ. ID No. 3 in the Sequence Listing.

(l) a DNA hybridizing with a base sequence comprising at least nucleotides Nos. 408 to 1121 out of the nucleotide sequence described in SEQ. ID No. 3 in the Sequence Listing or a probe prepared therefrom under a stringent condition and encoding a protein having an erythrose reductase activity.

22. The DNA as claimed in claim 21, wherein the stringent condition is a condition under which washing is performed at a salt concentration corresponding to 2×SSC containing 0.1% SDS at 60°C.

23. A cell to which a DNA has been transferred as claimed in any

one of claims 18 to 22 in a manner such that the DNA is capable of expressing an erythrose reductase type I the DNA encodes.

24. A method for producing erythrose reductase type I, comprising the steps of cultivating a cell as claimed in claim 23 in a medium to produce and accumulate erythrose reductase type I in a culture liquid and harvesting the erythrose reductase type I from the culture liquid.

25. A method for producing erythritol, comprising the steps of acting the protein having an erythrose reductase activity as claimed in any one of claim 1, 9 or 17 on D-erythrose and harvesting a produced erythritol.

26. A method for producing erythritol, comprising the steps of acting the cell as claimed in any one of claim 7, 15 or 23 on D-erythrose and harvesting a produced erythritol.